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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

WARREN, MATTHEW E

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 12/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/832,272

Applicant(s)

PRALL ET AL.

Examiner

Matthew E. Warren

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 September 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

This Office Action is in response to the Remarks filed on September 12, 2003.

Claim Objections

Claims 1, 3, 10, 13, 17, 22, 24, 31, 34, 38 are objected to because of the following informalities: all of the independent claims contain the limitation of an aspect ratio of 2.5." While the specification is enabling for the limitation, the specification explicitly states that the aspect ratio is "2.5:1." The quotation of "2.5" without something else to compare it to is not really a ratio, and is therefore confusing. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-52, as far as understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoki et al. (US 5,629,539) in view of Iacoponi (US 5,545,592). Aoki et al. shows (fig. 1b) a dynamic random access memory array (DRAM) comprising a substrate (10), a plurality of memory cells, each cell having field effect access transistors and a stacked capacitor (21b, 27, and 28). The field effect transistors have

source/drain regions (15b) that function as storage node junctions and are connected to the capacitor of the memory cell. The transistors also have second source/drain regions (15a) which functions as an access node junction and an insulated gate (13) overlying the substrate. The gate is insulated from the substrate by a gate dielectric (12) of silicon oxide and has vertical sidewalls (16) and an upper surface which are both covered by a dielectric of nitride (14). The gate electrode (13) comprises doped polysilicon. Along the length of the substrate, other access transistors are insulated from the substrate by a field oxide region (11). An interlevel dielectric layer (31) comprising a second dielectric material is blanketed over the substrate to a level above the capacitors. A plurality of digit line contact openings (having 21a and 24a) penetrate the interlevel dielectric layer and terminate at an access node junction (15a). The contact opening is self-aligned with the first dielectric material of the sidewall insulation of the gate because the contact is adjacent to the gate. The contact opening may be filled with a layered structure including tungsten and titanium (col. 8, lines 40-46). A digit line (33) is formed on top of the interlevel dielectric layer and makes electrical contact to the tungsten plug. Aoki shows all of the elements of the claims except the digit line contact opening having the specific titanium and CVD TiN and tungsten layer formed on the access node junction. Iacoponi shows (figs. 7) a contact structure comprising a contact opening formed in an interlayer dielectric layer (130). An access node junction (in silicon material 100) has a layer of titanium silicide (120) formed on it. A layer of titanium (150) is formed on the sidewalls of the opening. A CVD titanium nitride layer (160) and CVD tungsten (170) are subsequently deposited to fill the openings (col. 1,

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line 60 - col. 2, line 4). The silicide layer is formed by reacting the titanium with the source/drain region (col.1, lines 32-34). As can be seen from the figure, the titanium layer is overlying the silicide layer by does not make contact with the tungsten layer. The titanium/titanium nitride combination in conjunction with the silicide layer provides a low resistance electrical contact while the TiN provides a diffusion barrier for the underlying Ti layer and an adhesion promoter for the W layer (col. 1, lines 57 – col. 2, line 4). With respect to the limitation of the aspect ratio being at least 2.5 or 5:1, the it would have been obvious to one of ordinary skill in the art to make the aspect ratio within the desired range, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Furthermore, the limitation of the aspect ratio for the contact is well known for 256-megabit generation of DRAMS as stated in the applicant's Background of the Invention. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the contact opening of Aoki by adding a titanium metal layer and silicide to the access node junction of a transistor because Iacoponi teaches that such a configuration provides a low resistance electrical connection and adhesion promotion of tungsten.

With respect to the limitations of the CVD (chemical vapor deposited) titanium and tungsten and the reaction of titanium with silicon to form silicide, a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, **190 USPQ 15 at 17**(footnote 3). See also *in re Brown*, **173 USPQ 685**; *In re Luck*, **177 USPQ 523**; *In re Fessmann*, **180 USPQ 324**; *In re Avery*, **186 USPQ 116** in

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re Wertheim, **191 USPQ 90** (**209 USPQ 254** does not deal with this issue); and In re Marosi et al, **218 USPQ 289** final product per se which must be determined in a "product by, all of" claim, and not the patentability of the process, and that an old or obvious product, whether claimed in "product by process" claims or not. Note that Applicant has the burden of proof in such cases, as the above case law makes clear. "Even though product-by- process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

Response to Arguments

The applicant's arguments filed with respect to claims 1-52 have been fully considered but they are not persuasive. The applicant primarily argues that Aoki cannot be combined with Iacoponi because the combination would alter the method of manufacturing in Aoki, that Iacoponi does not provide motivation for using CVD TiN, and that the cited references do not show the claimed aspect ratio. The examiner believes that the references are still combinable and that the combination of references shows all of the elements of the claims.

With respect to the arguments that Aoki's manufacturing method is incompatible with the teaching of Iacoponi, the examiner still maintains that such an argument is

irrelevant when dealing with semiconductor devices. The statement found in Aoki "in order to obtain the above object the present invention uses the following structure and manufacturing method..." merely states that the invention is achieved by such a method. The statement does NOT REQUIRE that such a method ONLY be used to form a device. As one of ordinary skill in the art knows, there are many ways to form a device. The examiner merely looks to Aoki for certain aspects of the structure. If a modification or improvement is to be made to a semiconductor device, of course the original method of the primary references is going to be modified. This is inherent to all such combinations, but since the claims are directed to the device, and not the method, the modification of the method is permissible. Furthermore, Aoki does not blatantly teach or even suggest any incompatibility with using a CVD TiN and thus does not teach away from such a combination. Aoki's process is the novelty of the invention, but the structure formed is what is relied upon. The applicant's arguments would hold water if the claimed invention were a method, but since the claimed invention is a device, those arguments are irrelevant. Since the objective is to improve the device of Aoki, Iacoponi was cited to show an improvement to that device. As stated in the 103 rejection above, col. 1, lines 57 – col. 2, line 4 of Iacoponi clearly disclose that a TiN layer formed by CVD "acts as an adhesion promoter for tungsten contact formation" (col. 2 lines 2-3). Therefore, Iacoponi clearly states that the CVD TiN layer acts as an adhesion promoter for tungsten. Iacoponi shows motivation for using CVD TiN and one of ordinary skill in the art who desires improving the adhesion of tungsten in the contact would look to Iacoponi for such a teaching.

With respect to the argument that the claimed aspect ratio is not disclosed by the cited references, as stated in the rejection above, the cited ratios are merely ranges cited by the applicant and discoverable by one of ordinary skill in the art. The aspect ratio cited in the applicant's specification is not seen as critical because such a teaching is found in the Background of the Invention and is considered Prior Art. On page 4, paragraph [0008] of the specification, it is stated that "For the 256 megabit generation of DRAMs, contacts having contact aspect ratios of greater than 5:1 will likely be the norm." The rest of the paragraph goes on to contemplate various disadvantages pertaining to these types of contacts. The paragraph further goes on to state that collimator height-to-width aspect ratios have other disadvantages as well. As far as the examiner can tell, the teachings of the aspect ratios are merely prior art teachings at the time the invention was made and have nothing to do with the novelty or criticality of the invention. Because the specification discloses some sort of aspect ratio teachings, the 112 First paragraph rejection is removed, however because the specification does not provide some teaching as to how the ratio relates to the claimed invention, the limitation is merely seen as a prior art teaching that shows such ratios have been achieved in the past.

The examiner believes the Aoki and Iacoponi are still combinable for the reasons above and that the combined references show all of the elements of the claims. For these reasons, the 103 rejection is still proper and this action is made final.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (703) 305-0760. The examiner can normally be reached on Mon-Thurs, and alternating Fri, 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone number for the organization where this application or proceeding is assigned is (703) 305-3432.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

MEW
MEW
November 26, 2003

A. R. Wilson
ALLAN R. WILSON
PRIMARY EXAMINER